

A fast food restaurant serves its customers as a multiple-server multiple-line queuing system (See the picture on next page). A first-come-first-serve queue forms in front of each of the three cashiers. An arriving customer joins the end of the shortest queue. No jockeying is allowed (i.e., after joining a queue, the customer cannot jump to another queue). The arriving customer who finds six customers waiting in each line balks away and goes somewhere else for service. After the customer is served, he or she goes to the eating area with a probability of 0.8. What happens in the eating area is beyond the scope of our study and we assume that the customer exits from the system through the eating area. With the remaining probability of 0.2, the customer leaves the system through the exit door.

The random variables are characterized as given in Table 1. All values are given in seconds.

**Table 1. Probabilistic characterization of random phenomena**

<i>Random Variable</i>	<i>Probability Distribution</i>	<i>Parameters</i>
Interarrival times of customers	Exponential	Location = 0, Scale = 15.0
Cashier service time	Exponential	Location = 0, Scale = 40.0
Walk times from entrance to queue 1	Uniform	Min = 2, Max = 3
Walk times from entrance to queue 2	Uniform	Min = 2.5, Max = 3.5
Walk times from entrance to queue 3	Uniform	Min = 3, Max = 4
Walk times from entrance to exit	Uniform	Min = 1.5, Max = 2.5
Walk times from cashier 1 to exit	Uniform	Min = 3, Max = 4
Walk times from cashier 2 to exit	Uniform	Min = 4, Max = 5
Walk times from cashier 3 to exit	Uniform	Min = 5, Max = 6
Walk times from cashier 1 to eating area exit	Uniform	Min = 4, Max = 5
Walk times from cashier 2 to eating area exit	Uniform	Min = 5, Max = 6
Walk times from cashier 3 to eating area exit	Uniform	Min = 6, Max = 7
Walk times from one wait spot to another	Constant	2 seconds

Build a VSE visual simulation model, conduct experiments, and construct confidence intervals for the following performance measures of interest:

1. Utilization of each cashier
2. Average waiting time of customers in the whole system (from entry to exit) excluding the balking customers
3. Average number of customers in the whole system excluding the balking customers

**Submit the following on the due date** (See the lateness policy on the course Website.)

1. Compress the VSE folder representing your model. Name the compressed file *YourLastName.zip*. Make sure that your “zipping” preserves the folder structure.
2. Take screen shots of the VSE Output Analyzer windows showing the confidence intervals and place them in a Word file. Name the Word file *YourLastName.doc*
3. E-mail your *YourLastName.zip* and *YourLastName.doc* files to your GTA before the due date.

**Honor Code:** All work is to be done under the provisions of the [Virginia Tech Honor System](#).

